* =mandatory field)

- **Investigator**:*
  - **Name***: Dr. Christopher Sabine
  - **Organization**: NOAA/PMEL
  - **Address**:
    NOAA/PMEL
    7600 Sand Point Way NE
    Seattle Washington, 98115 USA
    Phone: 206-526-4809
  - **Email:** chris.sabine@noaa.gov
- **Dataset_Info**:*
  - Dataset_ID*: CCE2_121W_34N_Jan2010_Mar2011
  - **Submission_Dates**:*
    - Initial_Submission: 20111116 (YYYYMMDD)
    - Revised_Submission: 20150528 (YYYYMMDD)
- **Cruise_Info**:*
  - **Experiment**:
    - Experiment_Name*: Moorings and Time series
    - **Cruise**:**(-)**
      - Cruise_ID: (EXPOCODE) CCE220100117
      - Section: (Leg)
      - **Geographical_Coverage**:*
        - Geographical_Region: Pacific Ocean
        - **Bounds**:
          - Westernmost_Longitude:
            Enter decimal fractions of degrees:
            or Degrees, Minutes, Seconds:
          - Easternmost_Longitude:
            Enter decimal fractions of degrees: - 120.81 (+ = E, - = W)
            or Degrees, Minutes, Seconds:
          - Northernmost_Latitude:
            Enter decimal fractions of degrees:+34.32 (+ = E, - = W)
          - Southernmost_Latitude:
            Enter decimal fractions of degrees:
      - **Temporal_Coverage**:
        - Start_Date: 20100117 (YYYYMMDD)
        - End_Date: 20110305 (YYYYMMDD)
  - **Vessel**:* Mooring platform
    - Vessel_Name: CCE2_121W_34N Mooring
    - Vessel_ID:
    - Country:
    - Vessel_Owner:
- **Variables_Info**:*
  - **Variable**:
    - Variable_Name and Description*:
- xCO_2 SW (wet) (umol/mol) - Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature and measured humidity.
- CO2 SW QF – Quality Flag for xCO_2 SW (wet).
- H_2O SW (mmol/mol) - Mole fraction of H_2O in air from equilibrator .
- xCO_2 Air (wet) (umol/mol) - Mole fraction of CO_2 in air from airblock, 4 feet above the sea surface at measured humidity.
- CO2 Air QF – Quality Flag for xCO_2 Air (wet)
- H_2O Air (mmol/mol) - Mole fraction of H_2O in air from airblock, 4 feet above the sea surface.

- Licor Atm Pressure (hPa) – Atmospheric pressure at the airblock, 4 feet above the sea surface
- Licor Temp (C) – Temperature of the Infrared Licor 820 in degrees Celsius
- % O_2 - The percent oxygen of the surface seawater divided by the percent oxygen of the atmosphere at 4 feet above the sea surface. Disclaimer: The oxygen measurement is made in the equilibrated air. We have found that the oxygen does not come to complete equilibrium so any rapid changes in oxygen do not get properly captured using this system. Therefore, we tend to use the oxygen data only as a qualitative sense of the biology. It is not a quantitative measure.
- SST (C) - Sea Surface Temperature measured by CTD (MicroCAT C-T Recorder). Temperature data is internally recorded and collected during the equilibration period. Data not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO_2 calculation (within the degree of accuracy of the CO_2 measurement). Contact us if you would like the CTD post-calibration information.
- Salinity - Sea Surface Salinity measured by CTD (MicroCAT C-T Recorder). Conductivity data is internally recorded and collected during the equilibration period. Data not post-calibrated. Annual drift for this deployment was minimal and does not impact the fCO2 calculation (within the degree of accuracy of the CO_2 measurement). Contact us if you would like the CTD post-calibration information.
- xCO_2 SW (dry) (umol/mol) – Mole fraction of CO_2 in air in equilibrium with the seawater at sea surface temperature (dry air).
- xCO_2 Air (dry) (umol/mol) – Mole fraction of CO_2 in air at the airblock, 4 feet above the sea surface (dry air).
- fCO_2 SW (sat) uatm – Fugacity of CO_2 in air in equilibrium with the seawater at sea surface temperature (100% humidity). Since the measurements are taken at the sea surface, warming calculations are not necessary.
- fCO_2 Air (sat) uatm – Fugacity of CO_2 in air at the airblock, 4 feet above the sea surface (100% humidity).
- $dfCO_2$ – Difference of the fugacity of the CO_2 in seawater and the fugacity of the CO_2 in air (fCO_2 SW - fCO_2 Air).

- **Method_Description**:*
  - **Equilibrator_Design**:
    - Equilibrator_Type: (show pick list) Bubble Equilibrator
    - Equilibrator_Volume: (L) N/A
    - Water_Flow_Rate: (L/min) N/A
    - Headspace_Gas_Flow_Rate: (L/min) ~600 cc/min
    - Vented: (show pick list) Yes
  - Measurement_Method: Absolute, non-dispersive infrared (NDIR) gas analyzer
  - Manufacturer_of_Calibration_Gas: NOAA Earth System Research Laboratory (ESRL)
  - **CO_2_Sensors**:
    - **CO_2_Sensor**:
      - Manufacturer: Licor
      - Model: Environmental_Control: LI-820
      - Resolution: 0.01 ppm
      - Uncertainty: < 2.5% of reading with 14 cm bench (stated) <1.5 ppm determined in lab
      - CO_2_Sensor_Calibration: (For each calibration gas, document traceability to an internationally recognized scale, including date and place of last calibration. Include uncertainty of assigned value.)

        At the beginning of each sample, the instrument self-calibrates using a zero and high standard. The zero standard is generated by cycling a small amount of air through a soda lime chamber. The high standard is from a cylinder of calibrated standard reference gas, 437.11 umol/mol from ESRL. ESRL

standards are traceable to WMO x93 scale with a stated reproducibility of 0.06 micromole/mole.

- **Other_Sensors**: Oxygen Sensor
  - Manufacturer: Maxtec
  - Model: Max-250
  - Resolution: 0.01 %
  - Uncert-ainty: ± 2.0% Full Scale over operating temperature range
    ± 1.0% Full Scale @ constant temperature and pressure
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase. Recalibrated to sea level atmospheric air every 7 days.

- **Other_Sensors**: Humidity Sensor
  - Manufacturer: Sensirion
  - Model: SHT71
  - Resolution: 0.01 %
  - Uncertainty: Measurement range: 0-100% RH
    Absolute. RH accuracy: +/- 3% RH (20-80% RH)
    Repeatability RH: +/- 0.1% RH
  - Calibration: (For each sensor of pressure, temperature, and salinity, document traceability to an internationally recognized scale, including date and place of last calibration.)
    Factory calibrated before purchase.

- Method_References: (Publication(s) describing method)

Sabine, C. (2005): High-resolution ocean and atmosphere pCO_2 time-series measurements. The State of the Ocean and the Ocean Observing System for Climate, Annual Report, Fiscal Year 2004, NOAA/OGP/Office of Climate Observation, Section 3.32a, 246–253.

- Additional Information

- All measurements are at sea surface temperature and atmospheric pressure.

- During the equilibration cycle, a closed loop of air equilibrates with seawater for 10 minutes. Once the equilibration period is complete, the pump stops and the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- During the air cycle, fresh air is pumped through the detector for 1 minute. Once the pump stops, the system opens to the atmosphere allowing the pressure to equilibrate with atmospheric pressure. Measurements are recorded for 30 seconds at 2 hertz and then averaged.

- The gas streams for both the air cycle and equilibrator cycle are partially dried before entering the detector. The values listed as wet xCO_2 generally have relative humidity levels ranging from 40 to 80 percent. The humidity levels increase over the course of a deployment.

- Sampling occurs every 3 hours. The infrared detector is calibrated at the beginning of every sampling period. Averaged data and standard deviations for each measurement are transmitted back daily.

- To calculate the dry measurements, the water mole fraction in the Licor detector must be known. A relative humidity sensor is located immediately downstream of the detector.

- As part of the QC process, each data set is compared with the Marine Boundary Layer (MBL) data from GlobalView-CO_2. The data from this deployment were -4.6 ± 4.1 umol/mol on average of the MBL data and therefore no correction was applied.

GLOBALVIEW-CO_2: Cooperative Atmospheric Data Integration Project - Carbon Dioxide. CD-ROM, NOAA ESRL, Boulder, Colorado [Also available on Internet via anonymous FTP to ftp.cmdl.noaa.gov, Path: ccg/co2/GLOBALVIEW], 2010

-During the QC process, an adjustment to the Licor pressure is typically made based on each sensor's bias to barometric pressure as measured in the lab. We have not yet run this test on this system.

- No data = -9.999 or -999

- Data_set_References: (Publication(s) describing data set) None

- Citation: (How to cite this data set) Sutton, A., C. Sabine, S. Maenner, S. Musielewicz, R. Bott, and J. Osborne. 2011. High-resolution ocean and atmosphere pCO2 time-series measurements from mooring CCE2_121W_34N. http://cdiac.esd.ornl.gov/ftp/oceans/Moorings/CCE2_121W_34N/. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, Tennessee. doi: 10.3334/CDIAC/otg.TSM_CCE2_121W_34N
- **Data_Set_Link**:
  - URL*: http://cdiac.esd.ornl.gov/ftp/oceans/Moorings/CCE2_121W_34N/
- Label*:PMEL CO2 Group – CCE2 mooring
  - Link_Note: (Optional instructions or remarks)**(m s t)**

Quality Flags definitions:

2 = Acceptable measurement;
3 = Questionable measurement;
4 = Bad measurement
5 = Not reported;
9 = Sample not drown for this measurement from this bottle.

Quality Flag Log for this dataset.

Date	Measurement	Value (Dry)	Flag	Comments
5/16/2010 15:17	xCO2_SW	640.9884624	3	CO2 data submitted was adjusted by + 4 ppm b/c span calibration was off as predicted by change in Licor temperature
5/16/2010 15:17	xCO2_Air	387.4740587	3	CO2 data submitted was adjusted by + 4 ppm b/c span calibration was off as predicted by change in Licor temperature
7/7/2010 9:17	xCO2_Air	400.8877111	4	bad CO2 air data due to high st dev in air pump on cycle
7/8/2010 21:17	xCO2_Air	431.870794	4	bad CO2 air data due to high st dev in air pump on cycle
8/24/2010 0:17	xCO2_Air	382.8947914	4	bad CO2 air data due to high st dev in air pump on cycle
8/25/2010 15:17	xCO2_Air	390.7269649	4	bad CO2 air data due to high st dev in air pump on cycle
8/29/2010 21:17	xCO2_Air	396.9358685	4	bad CO2 air data due to high st dev in air pump on cycle
9/2/2010 21:17	xCO2_Air	389.9368743	4	bad CO2 air data due to high st dev in air pump on cycle
9/6/2010 15:17	xCO2_Air	604.0759825	4	bad CO2 air data due to high st dev in air pump on cycle
9/6/2010 21:17	xCO2_Air	408.9239727	4	bad CO2 air data due to high st dev in air pump on cycle
9/7/2010 15:17	xCO2_Air	503.1467325	4	bad CO2 air data due to high st dev in air pump on cycle

9/13/2010 18:17	xCO2_Air	387.2260322	4	bad CO2 air data due to high st dev in air pump on cycle
9/29/2010 18:17	xCO2_Air	481.4259578	4	likely bad CO2 air measurement but no problems in diagnostics
10/8/2010 15:17	xCO2_Air	396.7016791	4	bad CO2 air data due to high st dev in air pump on cycle
10/8/2010 18:17	xCO2_Air	408.4726172	4	bad CO2 air data due to high st dev in air pump on cycle
10/12/2010 15:17	xCO2_SW	410.8110223	4	bad CO2 sw data due to high st dev in equil pump on cycle
10/12/2010 21:17	xCO2_Air	411.4073537	4	bad CO2 air data due to high st dev in air pump on cycle
10/13/2010 15:17	xCO2_Air	416.5025723	4	bad CO2 air data due to high st dev in air pump on cycle
10/15/2010 18:17	xCO2_Air	400.0287648	4	bad CO2 air data due to high st dev in air pump on cycle
10/16/2010 0:17	xCO2_Air	409.9500619	4	bad CO2 air data due to high st dev in air pump on cycle
10/16/2010 12:17	xCO2_Air	469.6612715	4	bad CO2 air data due to high st dev in air pump on cycle
10/16/2010 21:17	xCO2_Air	432.7325348	4	bad CO2 air data due to high st dev in air pump on cycle
10/18/2010 15:17	xCO2_Air	409.5626941	4	bad CO2 air data due to high st dev in air pump on cycle
10/20/2010 15:17	xCO2_Air	435.6415221	4	likely bad CO2 air measurement but no problems in diagnostics
10/22/2010 18:17	xCO2_Air	472.6512986	4	likely bad CO2 air measurement but no problems in diagnostics
10/23/2010 0:17	xCO2_SW	393.1136197	4	bad CO2 sw data due to high st dev in equil pump on cycle
10/23/2010 12:17	xCO2_Air	443.3763703	4	likely bad CO2 air measurement but no problems in diagnostics
10/24/2010 9:17	xCO2_Air	433.9126033	4	likely bad CO2 air measurement but no problems in diagnostics
10/28/2010 0:17	xCO2_Air	442.3746778	4	likely bad CO2 air measurement but no problems in diagnostics
11/7/2010 6:17	xCO2_Air	428.6697579	4	bad CO2 air data due to high st dev in air pump on cycle
11/7/2010 18:17	xCO2_Air	422.3455882	4	bad CO2 air data due to high st dev in air pump on cycle
11/11/2010 21:17	xCO2_Air	662.2860503	4	bad CO2 air data due to high st dev in air pump on cycle
11/14/2010 21:17	xCO2_Air	525.055813	4	bad CO2 air data due to high st dev in air pump on cycle
11/16/2010 21:17	xCO2_SW	423.4572969	4	bad CO2 sw measurement due to pressure problem
11/16/2010 21:17	xCO2_Air	594.3811677	4	bad CO2 air data due to high st dev in air pump on cycle
11/17/2010 0:17	xCO2_Air	492.4813801	4	bad CO2 air data due to high st dev in air pump on cycle
11/25/2010 18:17	xCO2_Air	408.3705379	4	bad CO2 air data due to high st dev in air pump on cycle
12/24/2010 15:17	xCO2_Air	463.1335767	4	bad CO2 sw due to span calibration problem
12/26/2010 9:17	xCO2_Air	443.0725928	4	bad CO2 air data due to high st dev in air pump on cycle
1/4/2011 0:17	xCO2_Air	415.5612707	4	bad CO2 air data due to high st dev in air pump on cycle
1/5/2011 15:17	xCO2_Air	467.6599244	4	bad CO2 air data due to high st dev in air pump on cycle
1/5/2011 21:17	xCO2_SW	477.0411183	3	likely bad CO2 sw data due to high st dev in equil pump on cycle

1/6/2011 0:17	xCO2_SW	531.5770765	3	likely bad CO2 sw data due to high st dev in equil pump on cycle
1/11/2011 0:17	xCO2_Air	419.2927169	4	bad CO2 air data due to high st dev in air pump on cycle
1/15/2011 18:17	xCO2_Air	539.7820044	4	bad CO2 air data due to high st dev in air pump on cycle
1/20/2011 0:17	xCO2_SW	396.4503542	4	bad CO2 sw measurement due to pressure problem
1/23/2011 18:17	xCO2_Air	438.5936822	4	bad CO2 air data due to high st dev in air pump on cycle
1/24/2011 0:17	xCO2_SW	546.841408	4	bad CO2 sw measurement due to pressure problem
1/27/2011 12:17	xCO2_Air	492.2940362	4	bad CO2 air data due to high st dev in air pump on cycle
2/6/2011 15:17	xCO2_Air	497.7580522	4	bad CO2 air data due to high st dev in air pump on cycle
2/10/2011 0:17	xCO2_Air	437.9277789	4	bad CO2 air data due to high st dev in air pump on cycle
2/15/2011 15:17	xCO2_Air	400.1137599	4	bad CO2 air data due to high st dev in air pump on cycle
2/15/2011 18:17	xCO2_Air	404.5113337	4	bad CO2 air data due to high st dev in air pump on cycle
2/17/2011 21:17	xCO2_Air	398.0792179	4	bad CO2 air data due to high st dev in air pump on cycle
2/19/2011 18:17	xCO2_Air	432.327524	4	bad CO2 air data due to high st dev in air pump on cycle
2/22/2011 0:17	xCO2_Air	402.8266883	4	bad CO2 air data due to high st dev in air pump on cycle
2/22/2011 15:17	xCO2_Air	403.5545727	4	bad CO2 air data due to high st dev in air pump on cycle